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ABSTRACT

This autoinstructional packet, Part 1 of a two-part sequence, contains activities related to environmental education. Emphasis is placed on techniques used to obtain data on population growth and trends. It is suggested that it be used with high school students who have had a general introduction to the study of populations and can define same. The behavioral objectives are listed, divided into general objectives (3) and specific (2). A worksheet for answers and mathematical computations is included with the script. A bibliography is also included in the packet. (EB)

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MEASURING POPULATIONS
PART 1

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A-T TEACHER'S GUIDE

Packet Number - AT 311
D
P.I.

Title - "Measuring Populations - Part I"

Grade Level - High School

Subject - Populations

Prerequisites - A general introduction to populations that includes a definition of a population.

Behavioral Objectives - (attached)

Equipment and Material

Slide Viewer
Slide #1 (forest)
Slide #2 (barnacles)
Slide #3 (plankton)
Tape Recorder
Tape (Measuring Populations - Part I)
Seed Boards (Exhibits 1 & 2)
Pink 3" x 5" card with one inch square hole
Answer sheet
Chart of Objectives

Sample Evaluation - (use attached answer sheet)

Space Required - Carrel

Bibliography -

Biological Sciences Curriculum Study, Biological Science: Molecules to Man. Houghton Mifflin 1968, Chapter 27.

Biological Sciences Curriculum Study, Biological Science: An Inquiry into Life. Harcourt, Brace Inc. 1963, Chapter 40.

Biological Sciences Curriculum Study, High School Biology, Rand McNally, 1968, Chapter 2.

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A-T BEHAVIORAL OBJECTIVES

Measuring Populations - Part I

General

1. To take a census of a population.
2. To use sampling technique to estimate the size of a population.
3. To compute the density of a population.

Specific

1. Given sparce distribution of lettuce seeds over an 8" x 10" area, the student should be able to take a census to determine population size.

2. Given a dense distribution of lettuce seeds over an 8" x 10" area, the student should be able to determine the density of seeds per square inch and should be able to accurately estimate the total population size using sampling technique.

A-T ANSWER SHEET

Measuring Populations - Part I

Name _____

Class _____

Place Answers Here	Perform Work Here
Exhibit 1 1. _____ Total seed population Exhibit 2 1. _____ Density of seeds from 1st square inch sample 2. _____ Density of seeds from 2nd square inch sample 3. _____ Density of seeds from 3rd square inch sample 4. _____ Density of seeds from 4th square inch sample 5. _____ Density of seeds from 5th square inch sample 6. _____ Density of seeds from 6th square inch sample 7. _____ Density of seeds from 7th square inch sample 8. _____ Density of seeds from 8th square inch sample 9. _____ Density of seeds from 9th square inch sample 10. _____ Density of seeds from 10th square inch sample 11. _____ Average density of seeds per square inch 12. _____ Estimate of total seed population	

V

A-T SCRIPT

Measuring Populations - Part I

Hello, today's lesson is about measuring the size of populations. As you can probably recall from previous studies, the term population refers to all the individuals of a certain species that occupy a given area. For example, all the dandelions that occupy the school lawn make up a population. In this example the species is the dandelion and the area is the school lawn. Another example is the human population of Delaware. Here the species is man and the area is the state of Delaware.

Information about the size of a population is often of great importance to man. The lumber and paper industries are vitally interested in the number of trees of each species that will be available in the future. The seafood industry and sports fishermen would like to know the number of flounder in Delaware Bay. And the dairy bacteriologist who determines the number and kinds of bacteria in sample bottles of milk wants to know if the milk is safe for public consumption.

Counting populations is not always an easy task. Not only are there about two million different species scattered over various parts of the earth, but some species are not even visible unless viewed through a microscope. To get a better idea of the difficulties involved in measuring populations, place slide #1 in the viewer. Place slide #1 in the viewer now.

PAUSE

This slide shows a forest. A forestry biologist may be interested in determining the number of aspen or spruce trees in the forest. Obviously, the trees in a large forest number in the millions, some are tall and some short, and they may not be evenly distributed. Now place slide #2 in the viewer.

PAUSE

Slide #2 is a photograph of barnacles attached to a rock. Suppose it was your task to determine the number of barnacles on this rock. You can readily see that there are many of them crowded very closely together. In fact, some are on top of others. Now place slide #3 in the viewer.

PAUSE

This slide shows microscopic plant and animal life that is commonly found in ocean waters. Determining the population of these species would be difficult due to their microscopic size and the fact that they are constantly moving around. You may now remove slide #3 from the viewer.

PAUSE

Hopefully, this brief introduction has pointed out the need for population counts and some of the difficulties encountered in making them. We will now examine two methods used to actually measure populations. The first method we will employ is called census taking. Perhaps you can recall your parents filling out a form for the United States census that was taken in 1970. When this census was taken, every person in the United States was counted. At this time locate the white cardboard with the lettuce seeds laminated on it. It is labeled Exhibit 1. Place Exhibit 1 in front of you.

PAUSE

You are now going to measure the size of the lettuce seed population by taking a census. Remember, in taking a census all the individuals must be counted. What you must do is count all the seeds. Please turn the tape recorder off, count all the seeds, and record your answer on the answer sheet provided for you. Turn the tape recorder off now.

PAUSE

How many did you count? The correct answer is 80 seeds. It should be apparent to you that taking a census may be very time consuming and perhaps impossible if the population is extremely large. To overcome these difficulties, it is necessary to estimate the size of the population using sampling technique. In sampling, only a part of the population is counted. From this information it is possible to estimate the total population size. Now, locate Exhibit 2 and the pink 3" x 5" card and place these in front of you.

PAUSE

You will notice that Exhibit 2 contains a large number of lettuce seeds, and that it would be impractical to count all of them. We will now use the sampling technique to estimate the population of seeds. Place the pink 3" x 5" card over the seeds.

PAUSE

You will notice that a number of seeds can be seen in the 1 inch square hole which is cut in the card. This 1 inch square, represents the area of the sample, and the number of seeds visible in the square represents the sample itself. If a seed is partially in the square it should be counted only if more than about one half of it can be seen. Now, stop the tape recorder, count the number of seeds in the square, and record your answer on your answer sheet. Please stop the tape recorder.

PAUSE

The number of seeds you counted may vary. Let us say you have counted 12. Your number may be higher or lower, but let's use 12 as an example. This means that you have found 12 seeds per square inch. This quantity is called the density. Density refers to the number of individuals per given area. In this example the density is 12 seeds per square inch. Now, turn off the tape recorder and record the density from your own count.

PAUSE

Move the 3 x 5 card around over the seeds stopping at various places.

PAUSE

You will notice that at some places you stop there are many seeds in the 1 inch square and at other places just a few seeds are visible. In other words, the number of seeds varies. Since this number varies, the next task is to determine which area to sample. The most important thing to remember is about choosing the area to be sampled is that it must be chosen at random. There are many ways to take a random sample. Regardless of how you do it, you must insure that every square inch of area has an equal chance of being sampled. One way is to cover your eyes and move the 3" x 5" card around over the seeds. After moving it for a few seconds, stop and let it lie. Then count the number of seeds in the square. This technique is called random sampling.

You may be aware by now that just one sample may not be representative of the entire population. Therefore, it is necessary to take a number of random samples and compute the average. By taking 10 random samples and averaging them, you could get a more accurate estimate. Now, turn the tape recorder off, take 10 random samples, compute the average density per square inch, and record your data on your answer sheet.

PAUSE

Now that you have the average density per square inch, you can estimate the size of the entire population. You will note by looking at the seeds that the area they occupy measures 8 inches by 10 inches. The area of this rectangle is then 80 square inches which is computed by multiplying 8 by 10. Since the area you sampled was one square inch, then the area of the rectangle is 80 times larger. To compute the total population size, multiply 80 by the number of seeds that you counted per square inch. Turn the tape recorder off, compute the total population size, and record your answer.

PAUSE

The actual number of seeds in the rectangle is 869. How close did you come? Nobody's estimate is expected to be exactly 869, but your estimate should be approximately 869. If your estimate is not within 200 of the actual number, you may have made an error and it is recommended that you repeat this procedure before continuing with the next lesson on populations.

In summary, you have learned that taking a census involves counting all the individuals in a population. Census taking, though, is impractical when large populations are to be counted. To overcome this difficulty, sampling technique is used. In sampling, only a part of the population is counted. This part is assumed to be representative of the whole population. In this lesson you used only one type of sampling technique. Actually, a great many techniques may be used depending on the nature of the population. You also learned that density refers to the number of organisms per unit of area. By computing density the total size of the population can then be estimated. Data on population size provides man with information needed to better understand the world in which he lives.